AN EXTREME CASE OF PARASITISM.[1]

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There is a small family of minute animals belonging to one of the sub-divisions of the arthropods which is of especial interest on account of the parasitic habits of many of its members. One of these, *Sarcoptes scabiei* De G., is parasitic on the genus Homo.

Historical.—It seems that the Jewish physicians dwelling among the Moors of Spain, in the 12th century, knew something about these animals and their causative relation to the affliction known as the itch. The discovery of the microscope early in the 17th century (1619) led to many investigations, some of which had reference to the itch mites. The first good description of the mite bears the date of 1687, and was written by Bonomo to Redi, at Florence. After this, various observers saw the insect, but frequently it was confounded with other mites, especially the cheese mite. Linnæus in his Systema Naturæ, 1734, had a very imperfect idea of it.[2]

In the century following the first appearance of the Systema Naturæ, the mites, as causes of the itch, were frequently the subject of heated discussions among medical men. The identity of the human itch mite was better known to naturalists than to physicians.[3] For instance, in a large treatise on skin diseases by P. Rayer, originally published in Paris in 1835, the author, in describing the causes of the itch, says: "Causes —Scabies is one of the most universally disseminated contagious diseases known; the most momentary contact of the fluid secreted by its vesicles is enough to communicate the infection; it is observed in every climate during every season of the year, attacking all ages and persons in every rank of life, without discrimination. It is most commonly observed, however, among the poor and wretched," etc. Further on he

[1] Read before the Indiana Academy of Science, December 28, 1892.

[2] Hebra, "Diseases of the Skin," 1868. P. 168–180.

[3] Hebra, "Diseases of the Skin," 1868. P. 180–181.

says: "Several authors of modern times have reported that they have discovered an apterous insect, almost invisible to the naked eye, within the vesicles of scabies, which they have described under the name of acarus scabiei," etc. The author does not state whether he believes this.[4]

The labors of many observers in 1834 and 1836 firmly established the true nature of the itch or scabies. In 1845 and 1846 the minute anatomy of the insect was thoroughly studied and described.[5] The mite *Sarcoptes scabiei*, as the cause of the itch, was established beyond all doubt.

In recent medical works, I find there is little uniformity in regard to the systematic classification of this animal and its generic and specific names. The latter are variously given, the most popular seems to be *Acarus scabiei*. Frequently, all the different names are given. A recent treatise has it thus: "The acarus scabiei, sarcoptes scabiei, or sarcoptes hominis, commonly called the itch mite."[6] Authorities for names are never given. The accounts of the animal are often very brief and unsatisfactory. The size of the mites is variously given. According to some it is "very minute, almost microscopic;" according to others, "the size of a pin head." The pictures or figures of the mite differ greatly. In one work consulted—a standard text-book by the way—an entirely different mite is figured.[7] From the great numbers of mites which I had for comparison, I may say, without going into invidious distinctions, that the best figures I have seen are those in Taylor's "Atlas of Skin Diseases." Dr. Piffard's atlas contains an excellent photo-micrograph of the female acarus.

The itch mite is now universally called by entomologists Sarcoptes scabiei De Geer. The names Acarus scabiei and Sarcoptes hominis, given in many medical works should be dropped. Acarus and acari as synonyms for mite and mites are, of course, allowable.

The best description of the mite I have seen is Hebra's. It runs: "Body oval, tortoise-shaped, with indentations in the

[4] Reyer, "Diseases of the Skin" (John Bell), 1845. P. 135–136.

[5] Hebra, "Diseases of the Skin." P. 187–489.

[6] Shoemaker, "Diseases of the Skin," 1892. P. 700.

[7] Frey, "Microscope and Microscopical Technology," Cutter, 1880. P. 562.

lateral margins. Skin provided with shallow, undulating, transverse furrows. Dorsal surface covered with numerous small and large appendages of a clavate or conical form, or resembling scales, and with spines resting on papillary elevations. Head apparently distinct from the trunk, with four pairs of jaws, and two strong, three-jointed palpi, placed near the jaws, and of the same length. Legs eight in number, five jointed; the first and second pairs provided with pedunculated suckers—the peduncles of the same length as the legs themselves, and having no joints; the third and fourth pairs in the female terminating in long bristles. In the male, the first, second, and fourth pairs of legs are all provided with suckers, the third pair alone having bristles; the epimera of the first pair united. Larva presenting six legs—the first and second pair with suckers, the third pair terminating in long bristles." In regard to size, Hebra says: "The adult acarus varies in size. On an average, its length is 0.45 mm.; its breadth, at the fourth ring of the thorax, 0.35 mm. The male is considerably smaller than the female. In length it measures 0.23 mm.; in breadth, 0.19 mm. The eggs of the itch mite are of an ovid form, and are 0.16 mm. long, 0.11 mm. broad." It is, perhaps, unnecessary to say that the size of the animal is entirely out of proportion to the commotion it occasions when its presence becomes known.

The presence of the mite on the human body is characterized by certain appearances and symptoms known as 'scabies' or 'itch'. Scabies comes from scabere, to scratch. "The name of 'scabies' is, at the present day, used to designate the numerous appearances produced on the skin by the presence of acari which dwell within it, and which, in obtaining food for themselves, and in propagating their species, give rise to a continual irritation of its component tissues. The morbid appearances themselves resemble, in many respects, those caused by other irritants, but, taken as a whole, they nevertheless present certain peculiarities, which justify our making of them a distinct form of disease" Hebra.[8]

"Though the (*Sarcoptes scabiei*) is the essential cause of scabies, it must be remembered that eruptions almost, if not wholly

[8] Hebra, "Diseases of the Skin." P. 192.

identical, are produced by other species of the Sarcoptes derived from horses, dogs, cats, camels, sheep and rabbits."[9] Such cases are, however, rare.

It is, perhaps, unnecessary to add that the mite is never found in the body, only upon it, never in the organs or in the blood.

The human itch mite is perhaps coeval with man. It has certainly always existed as far back as written history goes.

Hebra, for good reasons, believes that many of the afflictions of the Israelites, as mentioned in the Old Testament, were nothing other than the itch.[10] Aggravated forms no doubt frequently occurred. Geologically speaking, the mites, as a group, are of recent appearance (Garman).[11]

The itch is, at the present time, becoming one of the rarer afflictions of mankind—like all filth diseases, it is gradually disappearing.

(In his Atlas of Skin Diseases (p. 319), Doctor R. W. Taylor says: "Until a few years ago, scabies was a rather uncommon disease *in this country*, but it has been noticed that in the various large cities and in some small communities, there has been of late, a remarkable increase in its prevalence." *Italics mine.*

In a recent letter to the writer, he expresses the belief that this is mainly due to the influx of Russian and Polish immigrants.

Cases are seldom seen outside of the slums of large cities; but it sometimes happens that if a case occur, say in a small town where none had appeared for years, perhaps half of the population becomes affected before its true nature is known, and appropriate remedies are applied. Vigorous medical treatment soon blots out an epidemic.

In an ordinary, acute or epidemic case of itch, the number of mites is quite small, probably not exceeding one hundred adult animals.

[9] Taylor, "Atlas of Skin Diseases." P. 327.

[10] Hebra, "Diseases of the Skin." P. 164–166.

[11] "Insect Life." Vol. IV., P. 182.

Recently I met with an extreme and rare case of the itch,[12] brought about by the presence in the skin of an immense number of itch mites. It shows to what extent parasitism will go under favorable conditions. The first detailed description of this rare form of itch was made by Hebra, of Vienna, in 1852, and who gave it the name of Scabies norvegica, or Norway itch, because the case was from Norway. Since then, other cases have been seen at various times and in different places, still, it is so rare that modern treatises on skin diseases do not describe it. Taylor's large "Atlas of Skin Diseases," devotes just two lines to it, as follows: "European writers, particularly of previous decades, have described a severe form of encrusted eczematous scabies, which they call Scabies norvegica, or Norway itch. It is not seen in this country."[13]

DESCRIPTION OF THE CASE.

The host of the mites was a middle-aged white man; he was partly paralyzed, and hence comparatively helpless. At the time of his admission to the City Hospital, his entire body was covered with thick, yellowish-white, leathery scales, the largest measuring over one inch in diameter, and over one-tenth inch in thickness. He was literally covered with scales like a fish.

On rubbing the body slightly, a large quantity of these scales fell off; rubbing more briskly removed an additional quantity, but with the production of small bleeding places (these scales were not crusts or scabs, they were epithelial proliferations). At a few places on the body crusts were found, mainly where the skin was bent, as at the joints. On account of the bleeding, no vigorous mechanical treatment was used at any time; the scales were gently rubbed off. A handful could be gathered daily. Despite this great alteration of the skin, the general health remained good. Taken in its entirety, the case was a puzzling one.

In a search for the cause of this eruption, and as an aid to the determination of the disease, some of the scales were sec-

[12] The case was described from a medical standpoint in the *Indiana Medical Journal* for November, 1892, by Dr. Brayton and myself.

[13] Taylor, "Atlas of Skin Diseases." P. 327.

tioned. Itch mites were found in abundance, and the nature of the disease was soon established.

In order to study the case more thoroughly, a number of the scales were prepared by usual histological method. The scales were fixed and hardened by immersion in alcohol, stained in picrocarmine, finally imbedded in paraffin, sectioned, affixed to slides with clove-oil collodion, and mounted in series. The shrinkage in passing through this process was very slight. The differential staining in this case was peculiar: the epithelium stained red, the mites yellow; the eggs remained unstained, that is, white; the fæces appeared dark brown or black. In staining sections of normal skin with picrocarmine, the outer or horny layer stains a bright yellow, the underlying protoplasmic layers stain more or less deeply red. In the present case the epithelium is peculiar in that well-stained sections show very little yellow; this indicates that the component cells are still protoplasmic, and have not cornified.

The activity going on in the columnar layer to replace this constant and enormous loss of cells must have been great. Apparently a vicious circle was established; the presence of the mites irritating the skin—the skin, to protect or rid itself from the parasites, pushed out a large number of new cells. These succulent cells, however, furnished a good nidus for the mites. The mites increased, causing increased irritation of the skin, and this caused an increased proliferation of cells. Thus the case went on, until it assumed this extreme form.

I may here say, that under appropriate anti-parasitic treatment at the hospital, the mites were soon exterminated. The cause of the irritation once removed, the skin gradually regained its normal character.

Number of Mites.—In order to obtain an idea of the number of mites present on the host, that is, at the time the mites were present in greatest numbers, several scales were cut to measure one-half by one-eighth inch, sectioned and mounted serially. It will be readily understood that in such a procedure the mites were cut in various planes and directions; sometimes the head would be seen in one section, the body in one or two other sections, and the tail in still another. Many of the smaller embryos and eggs appeared entire.

Anyone who has attempted to get numerical results from serial sections, will understand the difficulty of obtaining approximately correct figures. In the present case, two counts were made in each of three series of sections, and the mean of these counts was taken as an approximately correct number. Here are the figures:

Eggs and egg cases, 380.
Mites in all stages of development, 109.

Assuming that the above figures are approximately correct, we can make a little calculation: Multiplying the above numbers by 16, gives the number for one square inch; again multiplying by 144, gives the number for one square foot.

The average amount of epithelial covering on an adult human being, is said to be about 16 square feet. To be on the safe side, we will say that only half of the body was covered with scales, therefore, multiplying our last figures by eight, gives the number of eggs and egg-cases and mites on the host at the time of greatest abundance. Here are the figures in round numbers:

Egg cases and eggs, 7,000,000.
Mites, 2,000,000.

Since the reading of this paper, I tried to determine the proportion of eggs which are empty, that is, hatched. It seems that from one-half to three-fourths are empty shells.

As to the number of *living mites* in the shed scales. This is a difficult question. I am inclined to believe that only a small proportion were alive at the time the scales became detached.

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